

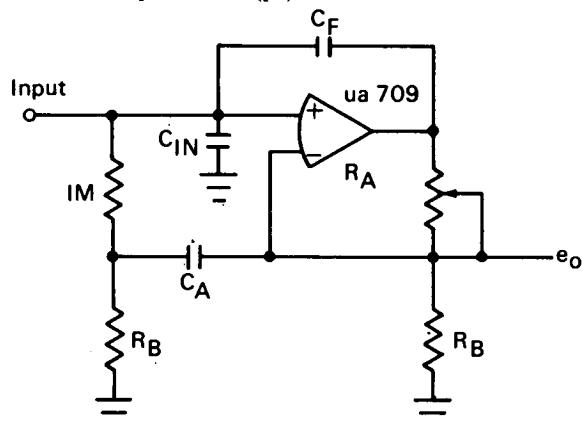
# NASA TECH BRIEF



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## AC-Coupled Ultrahigh Input Impedance Amplifier

High input impedance and low input capacitance have been achieved with a conventional unity gain buffer amplifier modified by the addition of positive feedback. The circuit, which is stable over a temperature range of 25° to 70°C, achieves input impedances of several hundred megohms and input capacitances of less than 1 picofarad (pf).



$$C_F = 68 \text{ Picofarads} \quad C_{IN} \approx 2 \text{ Picofarads}$$

$$C_A = 0.1 \text{ Microfarad}$$

$$R_A = 500\Omega \quad R_B = 10K$$

The high input impedance is obtained by positive feedback through capacitor  $C_A$  to the plus (+) input of the amplifier (see fig.). The input capacitance plus the capacitance to ground is  $C_{IN}$ , which can be cancelled by adding the feedback capacitor  $C_F$  and ad-

justing resistor  $R_A$ . The following relationship applies:

$$\frac{R_A}{R_B} \approx \frac{C_{IN}}{C_F}$$

Low frequency response is determined primarily by capacitor  $C_A$ , for which an electrolytic capacitor can be used. High frequency response is limited by the operational amplifier. The value of  $R_A$  is determined by applying a square wave to the input and adjusting  $R_A$  to produce an acceptable square wave output, in much the same manner that a 10X scope probe is adjusted.

The circuit was used to amplify a 5  $\mu$ sec wide pulse coupled through a capacitor of less than 1 pf. Slew rate for the circuit was approximately 0.5 V/ $\mu$ sec.

Gains other than unity can be obtained, but this would probably be simpler if another separate amplifier is used.

### Note:

No additional documentation is available. Specific questions, however, may be directed to:

Technology Utilization Officer  
Lewis Research Center  
21000 Brookpark Road  
Cleveland, Ohio 44135  
Reference: B70-10651

### Patent status:

No patent action is contemplated by NASA.

Source: Arthur G. Birchenough  
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Category 01